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AUTHOR Rude, Stanley H.
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ABSTRACT

Effects of symbolic modeling processes on exploration were investigated. Written narration reporting a novel experience was the symbolic model. Subjects read the material 1 or 3 times (Familiarity), with 1, 8, or 15 inserted exploration statements (Frequency), where such statements were specific or diversive (Exploration Type). With increased Familiarity, the observer's tendency to imitate decreased. Significant Sex x Exploration type, and Sex x Familiarity x Exploration type interactions indicated that males are in general more diversively curious; however, when the symbolic model displayed diversive exploration, females displayed more imitative behaviors. (Author)

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SYMBOLIC MODELING OF EXPLORATION

Stanley H. Rude
West Virginia University

A number of controlled investigations have yielded a substantial body of evidence indicating that maladaptive, as well as adaptive, behaviors may be learned via symbolic models. Symbolic models may be presented through pictures, verbal or written instructions, or through a combination of pictorial and verbal devices. Models that are pictorially presented may be provided through films, audiovisual displays, or television. Television has, most probably, played a major impacting role in providing symbolic models and stimulating research in observational learning.

A common utilization of symbolic modeling procedures has been to: eliminate or extinguish phobias (Bandura, Blanchard, and Ritter, 1969), increase social interactions in withdrawn individuals (O'Connor, 1969), or to decrease the occurrence of over-aggressive or otherwise maladaptive behaviors.

A classical investigation (Bandura, 1965), in which a symbolic model's aggressive behaviors were either punished, rewarded, or had no consequences associated with such behavior, demonstrated differential imitativeness according to the symbolic model's specific experimental condition. However, a post-experimental test, which included an incentive for matching the model's behavior, wiped out all of the previous experimental condition differences. Other uses of symbolic modeling procedures have shown that: dramatic play behaviors in children could be enhanced (Marshall and Hahn, 1967), video-mediated as opposed to written-mediated models were more effective in learning a teaching skill (Korna, Snow, and McDonald, 1971), and mildly retarded individuals could increase their production of specific

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grammatical constructions, via a symbolic modeling technique in the form of audio-tape recordings (Odom, Liebert, and Fernandez, 1969).

Although it is anecdotally apparent that human exploration is influenced by observing others explore (e.g., gourmet tasting by significant others), this influence has not been systematically studied. The present investigation's primary objective was to determine the nature of the effects of symbolic modeling processes on exploration. It has been reported that attitudinal changes or acquisitions (Bandura, Blanchard & Ritter, 1969; Bandura & McDonald, 1963), suggestibility (Jakubszak & Walters, 1959), and even dependency (Walters & Parke, 1964), can be facilitated via an observational learning procedure. However, the literature concerned with observational learning where a symbolic modeling technique has been utilized is not as conclusive, nor as plentiful, as those investigations of vicarious processes where non-symbolic models have been used. Within the sparse, but substantial, amount of investigations directed toward studying symbolic modeling techniques, the majority have attempted to demonstrate that maladaptive behaviors can be extinguished through exposure to a symbolic model. Moreover, the influence of a curious symbolic model, or one engaging in exploratory behavior, has not been investigated.

Of the many possible categorizations for exploratory responses (e.g., intrinsic vs. extrinsic, inspective vs. inquisitive, etc.) the dichotomy concerning specific and diversive exploration (Berlyne, 1960, 1965; Hutt, 1970) was selected for study in the present investigation. This dichotomy is based upon differences in sources of stimulation leading to exploratory behavior. When the source of stimulation is a single particular stimulus the examining behavior is termed specific exploration; whereas, when stimulation comes from a wide variety of sources, or is general in nature, the behavior is termed diversive exploration.

Few studies have addressed specific and diversive exploration directly (Berlyne, Koenig & Hirota, 1966; Day, 1968); although numerous experiments have been described as dealing with these concepts, they have been classified as such after the fact, rather than as having been designed to study these constructs at the outset.

The basic question addressed was "Will subjects tend to explore a situation to a greater extent if a symbolic model has shown an interest in, and explored that situation?" Also of interest was the question "How does repeated exposure to such symbolic modeling affect the observer's tendency to similarly explore?"

METHOD

Design

The overall design used was a 2x2x3 factorial which consisted of crossing two types of the symbolic model's exploration statements (specific and diversive), with two levels of the observer's familiarity with the symbolic model's narration (one and three readings of the material) and with three levels of the symbolic model's frequency of exploration statements (one, eight, and fifteen statements). The symbolic model used was the written narration of a story. Subjects read the experimental passage either one or three times (Familiarity), where one, eight, or fifteen exploration statements (Frequency) were included in the passage, with a symbolic model (narrator of the report) portraying exploration of either a specific or diversive (Exploration Type) nature. Possible covariates included in this investigations were paper and pencil measures of each subject's debilitating and facilitating anxiety. The total design was comprised of twelve groups (2 Exploration Types x 2 Familiarity x 3 Frequency) with a separate control group. The control group did not receive experimental treatments but responded to the dependent, and covariate, measures.

Subjects

A total of 208 undergraduate students (106 males and 102 females) participated in the experiment. The subjects were enrolled in either a Psychology 1, Psychology 2, or Geography 1, course at West Virginia University.

Stimulus Materials

The passage used was a 1911 word story (Rosenberg, 1969), in narrative form, about an individual's first experience with electroencephalography. This passage consisted of that individual's report of his experience in a feedback (EEG) experiment. Statements of specific and diversive exploration to be made by the symbolic model (narrator) were added at junctures of approximately every 127, 254, or 955 words, depending upon whether 1, 8, or 15 statements were inserted, respectively. These statements were single sentences, of from 19 to 24 words, which could be clearly classified as indicative of an individual who was engaging in either specific or diversive exploration. For example, the statements "Having never seen alpha rhythms, I was hoping he would show me what they looked like" and "I wanted to further examine the dynamics of this strange phenomenon, and tried to think of analogies other than the thermostat" are specific exploration statements. On the other hand, the statements "I was excited by the idea that new knowledge, no matter what its source, would be gained" and "I was pleased at the prospect of trying something different" are examples of diversive exploration statements. All of the statements were written with regard to the content of the passage and flowed unnoticeably within the narration.

Measures

The dependent measures were comprised of (a) ten specific exploration items, (b) ten diversive exploration items, (c) one specific future experiment participation item, and (d) one diversive future experiment participation item. Each of

the ten specific and ten diversive items had a five-choice frequency answer format (i.e., Always, Frequently, Sometimes, Rarely, and Never) and involved hypothetical situations indicative of an individual's proposed frequency of exploratory activity. Examples of specific exploration questions were "If I had the opportunity, I would like to investigate how something like conceptual control of brain processes might be related to mental illness" and "If given the opportunity to read, or learn about, documented research concerned with unusual things, such as the voluntary control of brain waves, I wish an expert would be around so I could ask him questions." On the other hand, the questions "If I had the choice, I would rather be in a situation where some risk or daring is involved than where it is a sure thing" and "If allowed the opportunity, I would like to work where each day brings unfamiliar situations to deal with" were examples of diversive exploration items. Both types of questions were either original, or were adapted from scales by Day (1969, 1971), Pearson (1970), and Zuckerman (1964).

The Future Experiment Participation measures (dependent measures) were questions (one each for specific and diversive exploration) pertaining to the subject's willingness to participate in an experiment planned for the future. The specific exploration future experiment participation measure informed the subject that "voluntary neural control of a slide projector" would be involved in the experiment. The diversive exploration behavioral measure informed the subject that other people in the department were conducting the experiment, and that we were "not sure about the details of the study." The answer format for these future participation measures utilized the choices: Yes, No, or I would have to know more about the experiment.

The covariate measure included in this investigation was a version of the Achievement Anxiety Test (Alpert & Haber, 1960).

The Achievement Anxiety Test is comprised of 19 statements (10 related to debilitating and 9 relating to facilitating anxiety) which yield separate scores for the two types of anxiety.

Procedure

Volunteer subjects reported to scheduled testing sessions and were tested in groups in ordinary classrooms with individual desks. Each subject sat at a desk and was provided with a test booklet and pencil. These booklets contained reading material, directions concerning how to proceed through the booklet and a series of questions (dependent measures). Directions varied according to experimental condition; however, the dependent measures were the same for all subjects.

RESULTS

Total specific exploration, total diversive exploration, and total exploration scores were obtained for each subject by summing the ten specific exploration items, the ten diversive exploration items, and the grand total of all 20 exploration items. A series of 2x2x3 factorial analyses of variance were performed on each of the three exploration measures to obtain an overall estimate of the error variance based on all of the experimental conditions, as well as to determine if any of the treatment effects were significant. It was found that the effect due to Familiarity, for the dependent measure specific exploration, was significant ($F = 5.40$, $df = 1/180$, $p < .05$). The effect due to Familiarity, for the dependent measure total exploration, was also significant ($F = 4.03$, $df = 1/180$, $p < .05$). The significant overall effect of Familiarity resulted primarily from a tendency of subjects in the Familiarity I condition (i.e., one reading of the experimental passage) to exhibit higher frequencies of exploration than did subjects in the Familiarity III condition (i.e., three readings).

In order to determine which of the anxiety measures should be used as covariates, product moment correlations between anxiety scores and exploration measures were computed. Significant relationships were found between facilitating anxiety and specific exploration ($r = .18$, $p < .05$), and between facilitating anxiety and total exploration ($r = .14$, $p < .05$). Accordingly, analyses of covariance were performed on the specific and total exploration scores using facilitating anxiety as the covariate. However, these new analyses, adjusted on the covariate, did not produce any additional significant relationships.

Analyses were also performed, with regard to the subject's willingness to become an active participant in an experiment, on the two future experiment participation measures. For the experimental conditions exposed to the specific exploration symbolic model, each group's frequency (i.e., 10, 6, 7, 8, 9, 6) of willingness to participate is greater than the frequency obtained with the control group (i.e., 5). The probability of the six specific, experimental groups all being greater in frequency than the control group by chance is $p < .016$ (by the binomial test). Moreover, when specific and diversive treatments are considered together, 11 of the 12 cells are greater than the control ($p < .003$, by the binomial test, that this would occur by chance). It is thus apparent that reading the passage creates interest in the topic as evidenced by increased willingness to be a participant in a similar experiment.

Analyses of variance (2x2x2x3) crossing Sex, along with Familiarity, Frequency, and Exploration Type were also performed on the specific and diversive exploration measures. For the specific exploration measure a significant Familiarity effect was found ($F = 5.56$, $df = 1/168$, $p < .05$), as was the Sex x Exploration Type x Familiarity x Frequency interaction ($F = 5.47$, $df = 2/168$, $p < .01$). The diversive

exploration measure showed a significant Sex x Exploration Type interaction ($F = 4.68$, $df = 1/168$, $p < .05$) as well as a significant Sex x Exploration Type x Familiarity interaction ($F = 4.17$, $df = 1/168$, $p < .05$).

The Familiarity main effect for specific exploration was expected (i.e., from previous 2x2x3 analyses), however, the 3rd order interaction was not, nor can it be easily explained. The significant Sex x Exploration Type and Sex x Exploration Type x Familiarity results are interesting since more information about the symbolic modeling process has been obtained. The former interaction shows, that, while males are generally more diversively curious, that is, in the specific exploration treatment condition ($\bar{X} = 36.95$ vs $\bar{X} = 34.47$, by the Duncan's Test, $p < .05$), females are more diversively curious after they are actually presented with diversive material ($\bar{X} = 34.47$ vs $\bar{X} = 36.77$, by the Duncan's Test, $p < .01$). For the Sex x Exploration x Familiarity interaction, the primary comparison of interest is the one between females in the diversive treatment condition for one vs three readings of the material, for Familiarity I, $\bar{X} = 39.53$, whereas for Familiarity III, $\bar{X} = 34.77$, ($p < .01$, by the Duncan's Test). In other words, upon repeated exposure to a passage involving a symbolic model's exploration, the observer's tendency to imitate that model, or to be curious about the situation in which the model is acting, will decrease.

DISCUSSION

Discussion of Findings

Several attributes, or factors, specific to the present experiment, could have contributed to the results obtained. For example, (1) nature of the constructs investigated, (2) composition of sample, (3) characteristics of the

dependent variables, (4) nature of the experimental task, (5) selection of specific levels of the independent variables, and (6) uncontrolled variance, are some of the factors that could have created the outcomes reported.

A major question to be answered in the present investigation was "Was exploration symbolically modeled; did observational learning and subsequent imitation occur?" The question appears to be an easy one to answer. Simply compare those groups that receive exploration, or modeling, treatment with a group that has not received the treatment (i.e., the control group). This was done, using a symbolic model who made statements about his own curiosity and desire to explore in a novel setting. The general finding was that these comparisons were not significantly different ($p > .05$). This lack of an effect (due to treatments) was consistent across the three dependent measures. This failure to produce a significant relationship might be attributable to:

(1) invalid dependent measures
(2) ineffective experimental treatments
(3) facilitation of exploration is not possible with symbolic models

Each of these three possibilities will be discussed in turn.

A possible cause for the failure to produce a significant modeling effect could have been invalid dependent measures. These items were constructed to represent the dimensions typically defined as specific and diversive exploration (e.g., Hutt, 1970). That is, the items by reasonable standards appeared to have adequate content validity. In this respect, the inter-item correlations, as well as the item-to-total correlations were significant. The issue of major interest, however, concerns vaildity of the specific and diversive exploration constructs. While these appear to be genuine constructs, as evidenced by the experimental work in the area, the question still remains whether or not the present dependent measures adequately assessed these constructs.

Another factor mentioned as a possible deterrent to finding a significant modeling effect was that of ineffective experimental treatments. The possibility that too few statements were used by the symbolic model is a realistic concern. Different results might have been obtained if 1, 25, and 50 statements were used. In addition, portrayal of curiosity via statements of interest may not be as effective as having the symbolic model display curiosity by asking questions, rather than by stating his degree of interest.

Finally, insignificant effects due to modeling may have resulted because facilitation of exploration is not possible with symbolic models. A case for this explanation appears to be weaker than the other two previously discussed. Since, from the literature review, it was noted that roles, attitudes, opinions, and prejudices can be observationally learned through models (e.g., Bandura, 1968, 1971; Bandura, Blanchard, & Ritter, 1969; Bandura & McDonald, 1963; Rhine, 1958), there is little reason to suspect that exploration tendencies could not also be facilitated through this process. However, the possibility exists that modeling of exploration reduces the novelty of the situation for the observer. Thus, on a subsequent occasion, the tendency to perform as the model did is balanced by a tendency not to explore in the presence of familiar stimuli.

A significant main effect ($p < .05$) for Familiarity (i.e., increased familiarity reduces exploration tendencies) was obtained with the specific exploration and total exploration dependent measures; however, this was not the case with the diversive exploration measure ($p > .05$). In other words, statistical evidence supports the contention that upon repeated exposure to a passage involving a symbolic model's exploration, the observer's tendency to imitate that model, or to be curious about the situation in which the model is acting, will decrease.

Berlyne's work (1960, 1963) suggests that the initially novel stimulation (i.e., one reading of the experimental passage) was effective in producing conceptual conflict, resulting in the tendency of those subjects to exhibit interest in similar situations. The conflict in such situations is considered a product of discrepancy between the drive-stimulus of the present situation and former drive-produced responses (past exploration). However, when the experimental passage was read three times, the novelty of it was relatively less, and thus conflict between the drive-stimulus and former drive-produced responses was lessened, with decreased interest in stimulus exploration resulting.

The habituation hypothesis holds that those effects peculiar to novel stimuli become lessened upon repeated exposures, or increased familiarity (e.g., Danziger & Mainland, 1954). A similar explanation is provided by a stimulus satiation (e.g., Glanzer, 1958) analysis, which holds that stimuli lose their peculiar effects due to the subject's degree of exposure to them.

Another, although less convincing, line of reasoning might suggest that an optimal level of stimulation (e.g., Leuba, 1955) occurred after one exposure to the passage and symbolic model. In other words, the overall level of stimulation was greater (with three exposures) than the amount needed, therefore subjects reacted to this overstimulation by exhibiting a decreasing frequency of exploration preference. A post hoc explanation may also be made in terms of optimal activation and arousal levels (e.g., Hebb, 1955).

Very simply and descriptively, one may suggest that enough information was extracted from one reading to create a tendency to explore similar situations, or stimulation. By increasing these exposures, a lowered tendency to explore similiar situations resulted. What once constituted a disposition toward exploration, with

increased familiarity became the object of little interest. Decreased novelty, increased familiarity, habituation, conflict reduction, and arousal-satiation, appear to be similar in many respects, and constitute the most reasonable explanation of the familiarity effect.

Another finding reported was the small, but significant, correlation ($p < .05$) obtained between facilitating anxiety and total specific exploration. In other words, subjects with higher facilitating anxiety tended to show greater preference for exploring situations related to the neural control of a slide projector. This might have been due to the fact that this type of specific exploration contains overtones of an anxiety provoking atmosphere; hence, subjects high in facilitating anxiety will tend to explore this type of situation more than subjects low in facilitating anxiety.

In summary, the results of the data analyses reported indicated that symbolic modeling of exploration is not affected by the number of exploration statements made by a symbolic model. However, upon repeated exposure to the symbolic model (increased familiarity) a significant effect was produced. With written materials featuring a symbolic model, the exploration interest created by one exposure is greater than that generated by three exposures.

A Theory of Exploration

Depending upon whether one views exploration as a (1) process or product, (2) personality attribute, (3) environmentally determined or situationally controlled variable, or (4) innate motivational state, he will go about systematically explaining exploration differently. For example, Langevin (1971) has suggested that curiosity in humans may be class fied as follows:

(1) curiosity as a motivational state measured by
(a) free exploration, (b) selective attention, and
(c) verbal expressions of preference or interest in

> complexity, novelty, and incongruity, and (d) number of questions asked, (e) physiological indicators (e.g., GSR and EEG), and (2) curiosity as a personality trait measured by (a) personality questionnaires, and (b) teacher-peer ratings (Langevin, 1971, P. 361).

Different interpretations of exploration and curiosity (e.g., conflict-arousal, optimal level of stimualtion, fear of novelty, etc.) have been reported. The following is the present author's proposed theory of curiosity based upon portions of other theoretical formulations and empirical reports.

First of all, it is the present writer's contention that curiosity and exploration are not interchangeable terms. Curiosity is a mechanism which may or may not result in overt or measurable exploration. On the other hand, if exploration has been demonstrated (e.g., attention, perseveration, etc.) then curiosity may be inferred. The antecedent to this inference may be due to situational characteristics (e.g., stimulus conditions) or an individual's propensities (e.g., previous encounters with similar situations); the consequence is, as was stated, the overt exploration. The following is the present interpretation:

> Curiosity is a temporary state of the organism. It is primarily determined by antecedent conditions (e.g., stimulus novelty, sensory deprivation, etc.). Curiosity is a middle link in the chain of events which leads to exploration. More specifically, overt exploration in combination with suitable antecedents is sufficient evidence for inferring curiosity. Through antecedent stimulus dimensions (both situational and historical) a portion of the CNS is excited. This excitation may be terminated in one of two ways: (1) through manifestation of exploration-related behaviors (e.g., orienting responses, locomotor activities, manipulation, investigation, etc.), which may be of an internal or external nature, and (2) excitation may cease when other areas of the brain are in the states of fatigue, satiation, etc., or when other more-curiosity-provoking stimuli are perceived. Curiosity is then initiated and terminated in accordance with functional states of the CNS. That is, the characteristics of the stimulation (external), and the disposition (internal) of the in-

dividual, interact in such a way that the brain is in a unique state, which we have termed curiosity. The present state of knowledge concerning sensory and association neural functions does not allow reasonable speculation beyond this point. However, the present theory is amenable to general testing through standard neural firing and EEG physiological research technique.

Recommendations

The following considerations for future research are provided to clarify aspects of the proposed theory, and also to build upon the findings obtained from the present investigation:

(1) experiments to test the effects of other novel specific exploration materials, or situations (e.g., reading materials, modes of individual-learning, etc.).

(2) experiments to test the effects of live, filmed, or televised, symbolic models engaging in exploratory activities.

(3) experiments to test the above neural action theory, using infra-humans, and administering drugs which enhance or inhibit the RAS to determine the effects of exploration. Further, one might determine human firing patterns or EEG results under different exploration conditions.

(4) an experiment using self-report inventories (e.g., locus of control, conformity, dogmatism, creativity, etc.) to determine which antecedent factors might relate to exploration through modeling.

(5) experiments to test the effects of similarities and differences in the modeling of exploration with different populations (e.g., preschool children, retired persons, retardates, etc.)

Other areas of possible investigation include use of: questioning models, different experimental-statistical models (e.g., randomized versus fixed models), having the model visually versus verbally display exploration-related behaviors to the observer, and use of several different collative variables (i.e., novelty, complexity, unexpectedness, surprise, etc.).

In summary, the results considered indicate the following: (1) increased familiarity reduces exploration tendency, (2) sex differences for exploration type preference (specific vs diversive) do exist, and (3) reading about this symbolic model's novel experience increased the observers' willingness to participate in similar experiences.

Although any generalization from the present study should be limited to written symbolic models, the importance of this investigation is, that symbolic modeling of exploration may occur from one exposure. Moreover, to increase the possibility of sustaining an individual's curiosity, use as many different examples as possible.

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